Forward Modelling Case Study

Salt Diapirism and Over-burden Deformation

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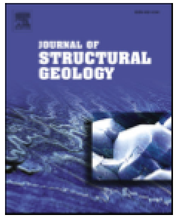

Integrating kinematic restoration and forward finite element simulations to constrain the evolution of salt diapirism and overburden deformation in evaporite basins

Check for updates

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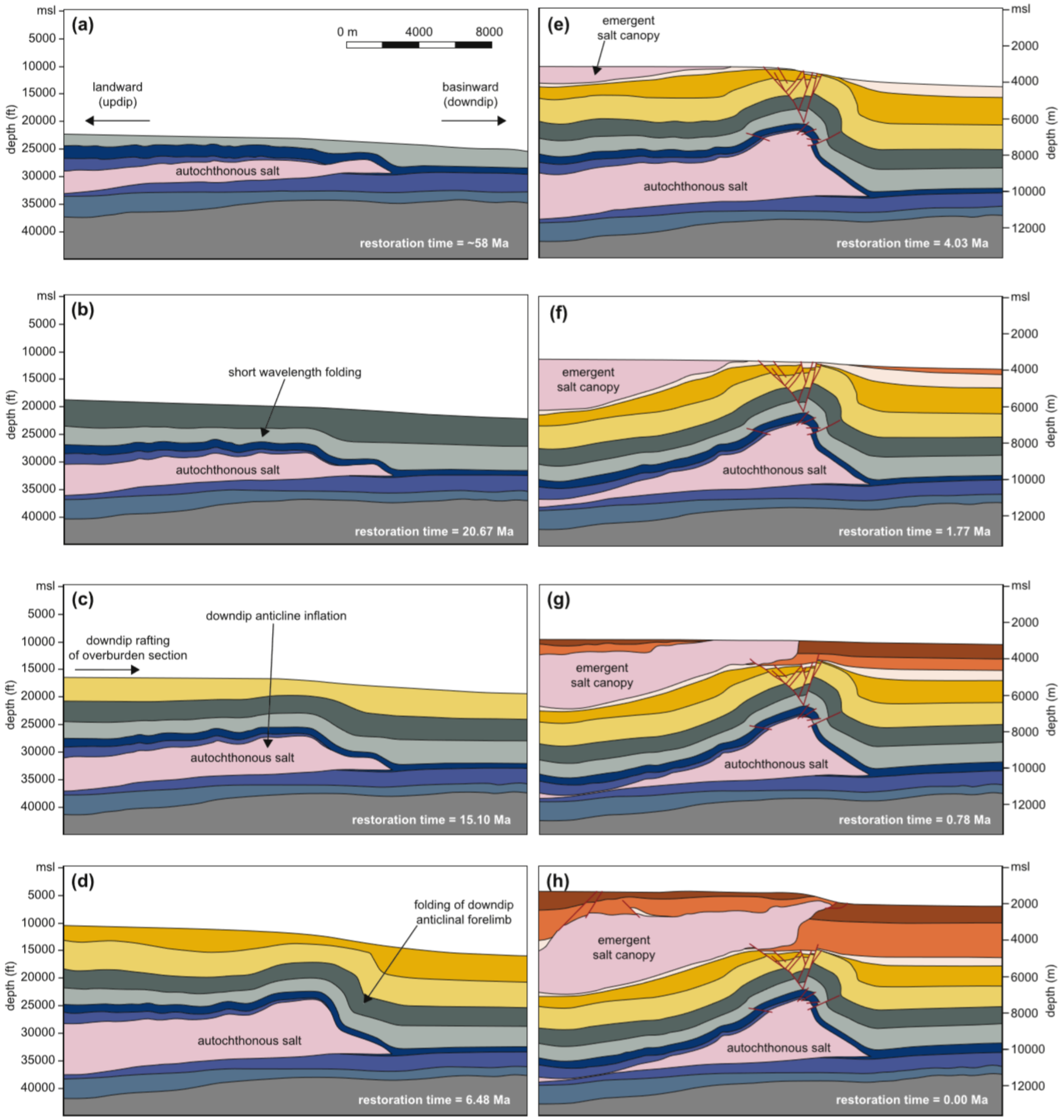
- **Overview**
  - In evaporite basins, salt deformation including inflation, diapirism, and salt canopy emplacement is inherently non-coaxial and ductile and thus is challenging for two-dimensional kinematic restorations that rely on line-length and area-balancing assumptions.
  - Also, because salt flow and the resulting deformation of cover units can be driven by temporally and spatially transient salt pressure gradients, kinematic restorations are generally unable to predict the magnitude and distribution of sub-seismic deformation.
  - Presented is a case study from the Atwater fold belt, Gulf of Mexico, using a new workflow that involves comparison of kinematic restoration models (presented to the right) with forward models of structural evolution to examine the physical validity of solutions derived from the kinematic restorations and to determine the nature and spatial distribution of the resultant sub-seismic deformation.



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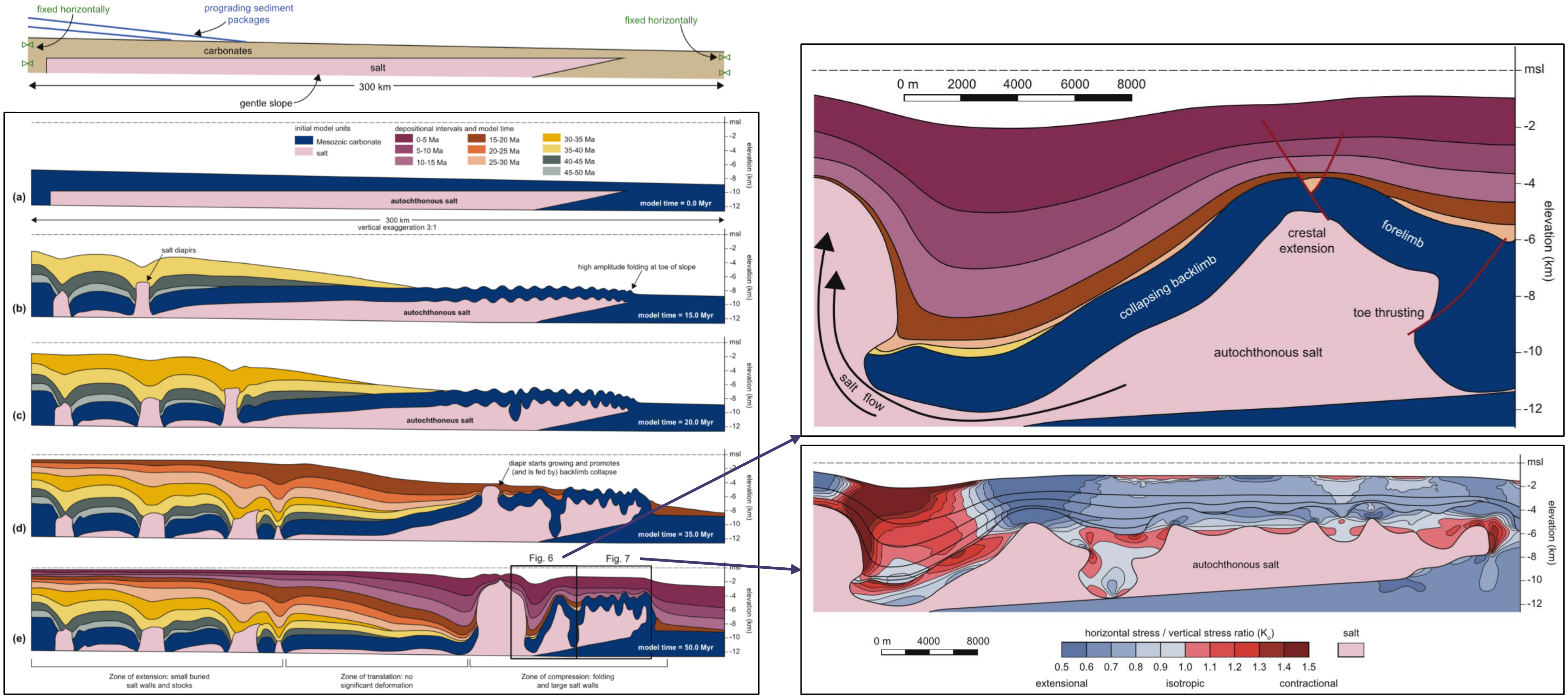
Forward Model output – Model initial setup, evolution and stress state



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- **Summary**
  - These models show that the stress field, and particularly the K value (horizontal-vertical stress ratio) of the sediments adjacent to salt structures used for estimating stress magnitudes for drilling predictions, is fundamentally dependent on where along the evolutionary path from autochthonous salt, to diapir, to salt sheet, that each structure resides
  - These results highlight the need to test complex kinematic restorations with physics-based techniques
  - Additionally, they demonstrate that integrating kinematic restorations with these finite element solutions can substantially increase our ability to predict both sub-seismic reservoir damage in sediments adjacent to salt structures and the K values used for forecasting drilling conditions
  - This is particularly significant in an exploration context, where the paucity of well data creates a greater necessity to bolster forecasted conditions with geomechanical modeling, among other techniques